

# COMMISSIONING A MATERIALS RESEARCH LABORATORY

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Sandia National Laboratories

Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the United States Department of Energy under contract DE-AC04-94AL85000

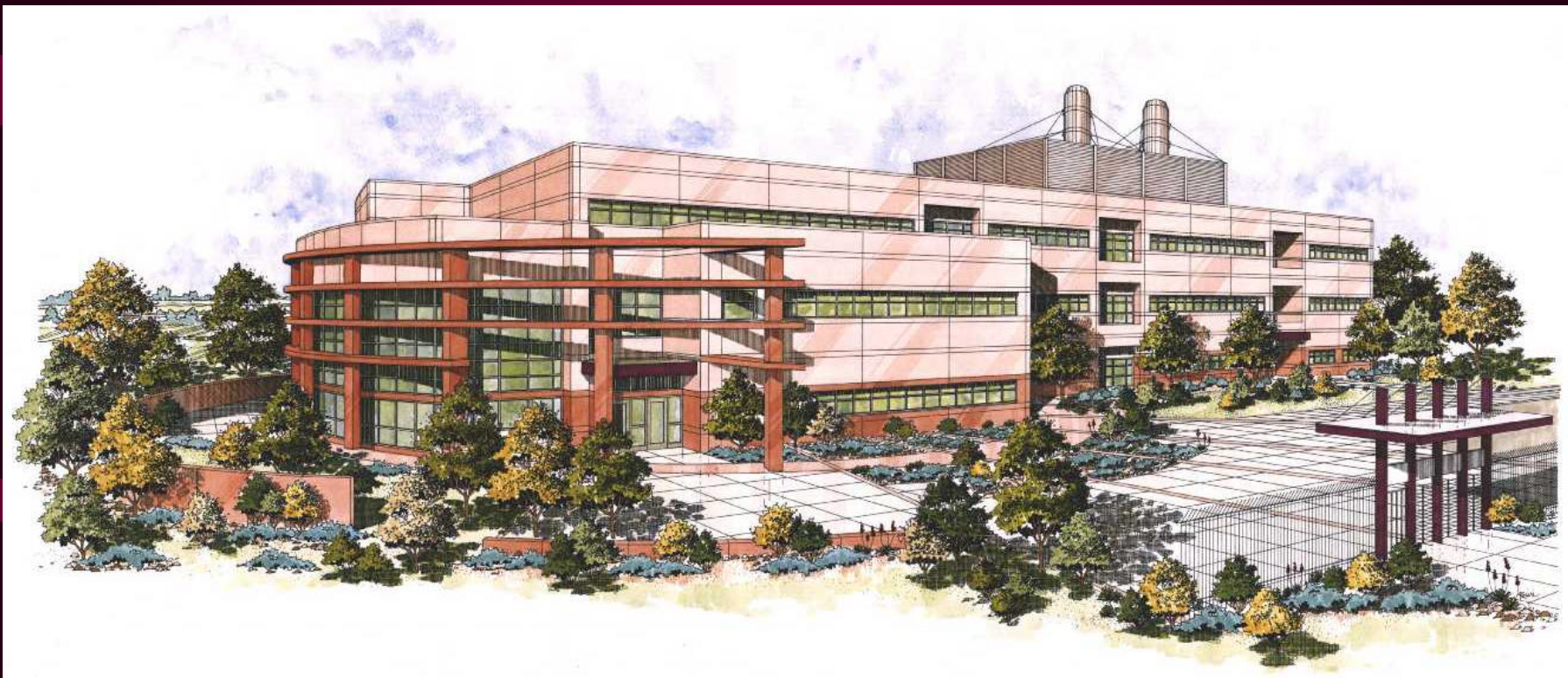
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# Synopsis

- Commissioning Background at Sandia
- Building Use and Design Information
- Sandia's Unique Situation
- Conceptual Design Phase

# Synopsis

- Early Design Phase
- Final Design Phase
- Construction
- Evaluation



PETL

# Background Information

*“We’ve All Been There”*

- Commissioning elements
- Some elements were being utilized
- Not very organized or consistent
- Buildings were becoming more complex
- Organization and buy-in problems

# Building Use and Design Information

- PETL, or the “Processing and Environmental Technology Laboratory,” is a 150,000-sq.-ft. materials research laboratory located at Sandia National Laboratories in Albuquerque, New Mexico
- Three-story concrete structure with pre-cast exterior
- Construction cost of \$178 per sq. ft.

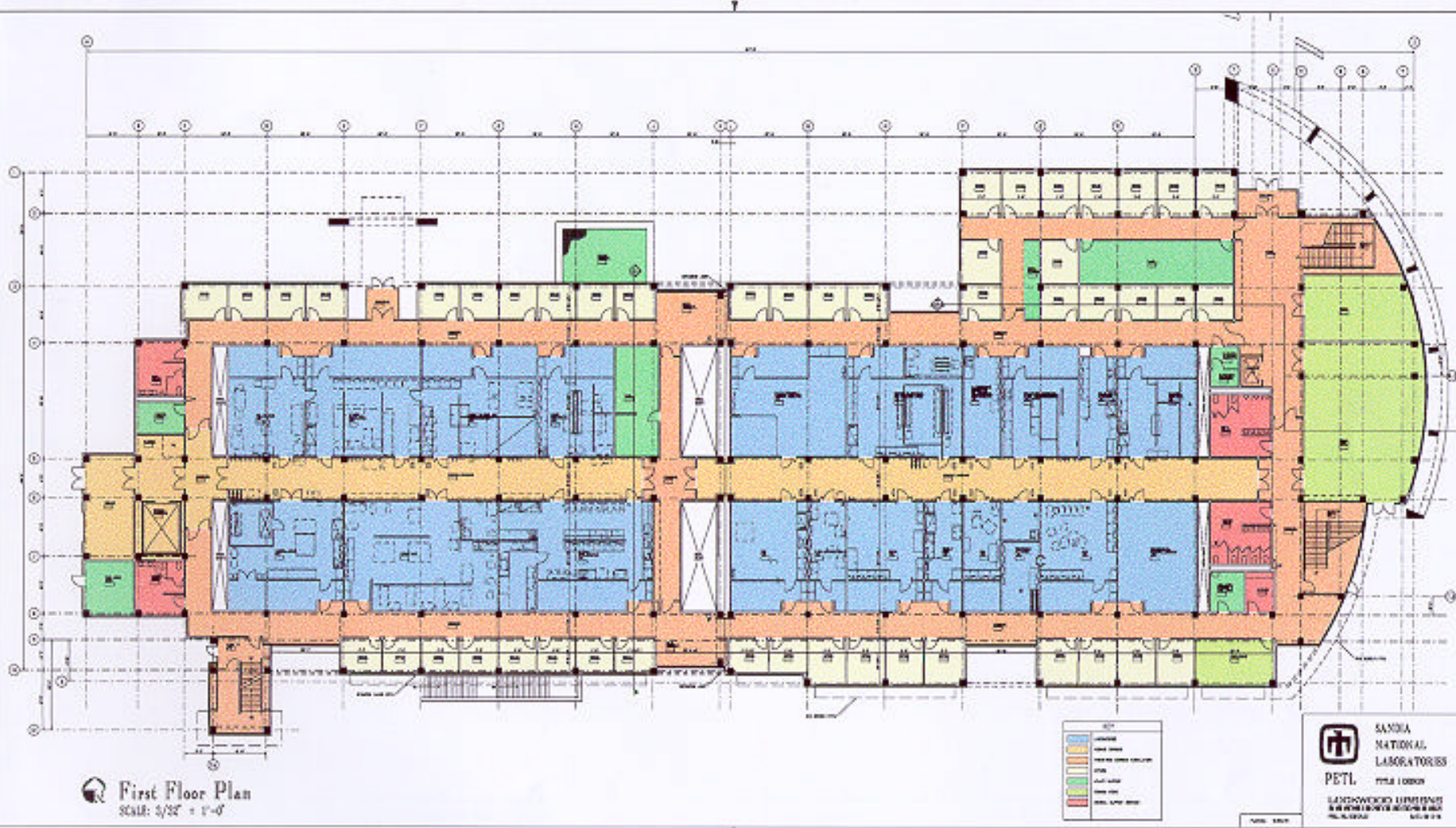
# Lab Types

- Organic Chemistry
- Welding
- Thin Films
- Ceramics
- Corrosion

# Design Information

- Central core of labs with perimeter offices
- UBC, H-6 laboratories with “Chemical Free Zones” for technicians
- Once-through lab air
- Flexible lab utility arrangement
- Utility zoning
- Waffle slabs for vibration criteria



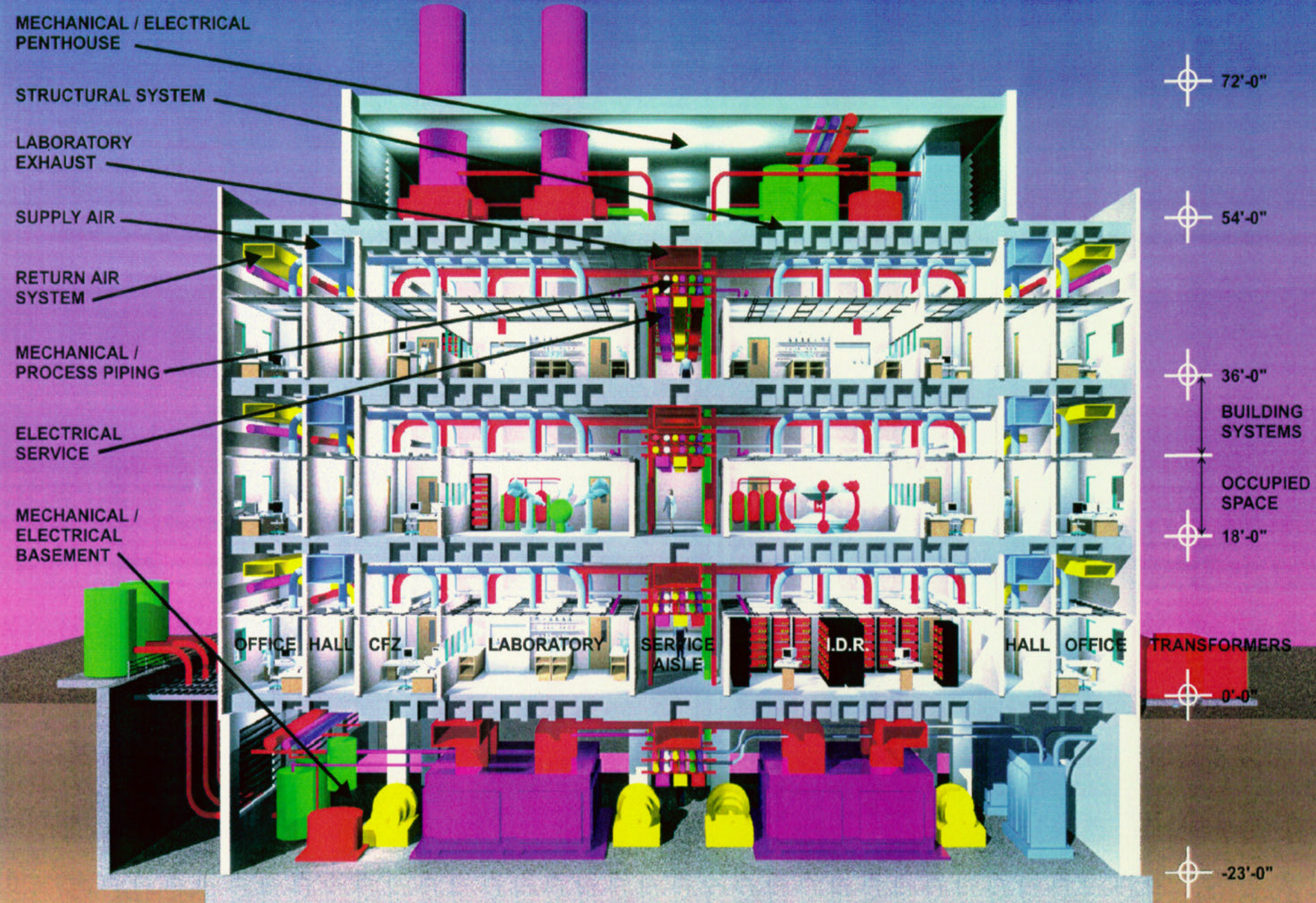


**First Floor Plan**  
SCALE: 3/32" = 1'-0"

- | KEY    |            |
|--------|------------|
| Blue   | LABORATORY |
| Orange | OFFICE     |
| Yellow | STORAGE    |
| Green  | EQUIPMENT  |
| Red    | RESTROOMS  |
| Purple | STAIRS     |

**SANDIA NATIONAL LABORATORIES**  
PETL  
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**TYPICAL LABORATORY SECTION PERSPECTIVE**

**FMSM ARCHITECTS**  
Rendering by Dave Williams



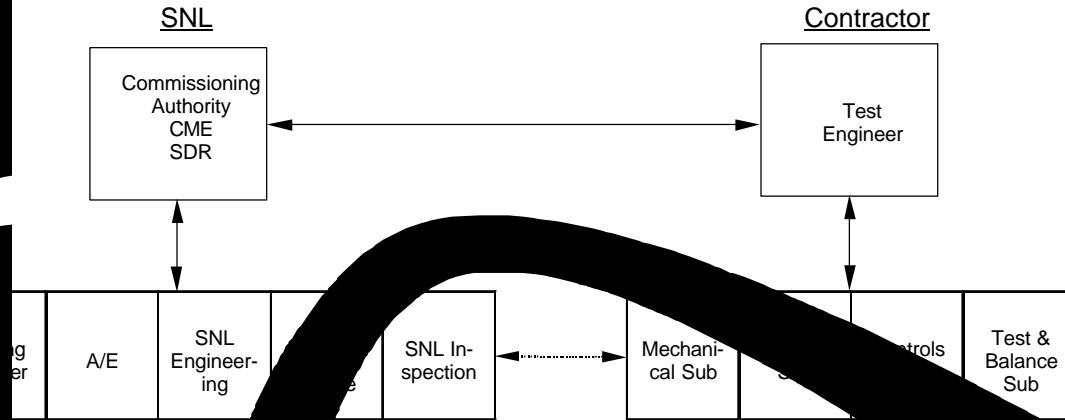
# Modern Laboratories Are Very Complex

- Safety
- Internal and External Environmental Issues
- Energy Usage and Efficiency
- Flexibility and Future Use

# Sandia's Unique Situation

- We already had design team elements
- Internal inspection department
- Project managers
- Large cache of historical knowledge
- Used to DOE and other rules and regulations

# Commissioning Overview Chart



## SNL Responsibilities

- Produce commissioning specification
- Provide basis of design, operations, design drawing specifications
- Plan and attend commissioning meetings
- Provide QA reviews of contractor submittals
- Accept and QA reports from contractor
- Attend witness tests, acknowledge attendance on test forms
- Provide engineering for any change orders
- Select and provide O&M training candidates

## Contractor Responsibilities

- Produce commissioning plan: test schedule, test plan, procedures, etc.
- Coordinate subs
- Contract with EMCS programming and T&B from SNL-approved lists
- Review/QA EMCS programming
- Produce commissioning reports
- Attend commissioning meetings
- Conduct tests
- Coordinate testing
- Set up and conduct O&M training
- Produce final commissioning report and close-out package

# Conceptual Design Phase

- Conceptual Design Report
- Programming Meetings
- High-level decisions
- Set scope for the project
- Commissioning scope and players defined
- Normal point to have Commissioning Authority/Team on board

# Commissioning Impacts

“What did Commissioning do for this phase?”

- Vehicle to input lessons learned
- Identified special customer requirements
- Helped define applicable codes
- Addition of Thermal Storage System
- Defined need for Utility Zoning

# Early Design Phase “Title I”

- Written commissioning specification completed for construction documents
- Final decision was made to have contractor own the T&B and controls software work
- Sought internal acceptance of Commissioning Specification



# Commissioning Impacts

“What did commissioning do for the early design phase?”

- Separate air intakes were added to the air handling units
- An evaporative cooling section was added to the exhaust system, 15% efficiency increase
- 50% diversity was taken on the lab air
- New cost-saving Fume Hood Controllers

# Final Design Phase “Title II”

- Facilities changes had little impact
- A/Es can only be expected to do so much
- Commissioning takes over to enhance the design for the customer

# Commissioning Impacts

“What did commissioning do for the final design phase?”

- Large portion of the return air ductwork was removed
- One-hour firewall requirement removed
- Multiple boiler system specification added
- Duct pressure class rating lowered
- Exhaust duct material explored and changed

# Construction Phase “Title III”

- Commissioning specification differences brought out in Pre Bid and Pre Con
- Partnering initiated
- Delays in getting Test Engineer and Commissioning Schedule
- Test Engineer and Controls Contractor selections were very good for the project

# Commissioning Impacts

“What did commissioning do for the construction phase?”

- Scheduling problems were identified
- Sequence of operations extensively reviewed
- Commissioning notebooks started
- Missing safety systems identified

- HVAC min/max problems identified
- Equipment baselines initiated
- First-floor waffle slab redesigned to help with construction schedule
- Internal Web site added for public relations

# Evaluation of Commissioning for the PETL Project

- PETL Commissioning as a learning tool
- PETL Commissioning is ongoing
- Commissioning at Sandia versus normal design team involvement
- No credit taken for Value Engineering

# Commissioning Value vs. No Commissioning

- Cost of Commissioning was approximately \$1,000,000 or a little less than 4%
- Avoided Costs
  - Return air ducting \$50,000
  - Changing fume hood controllers \$125,000
  - Exhaust system materials change \$800,000
  - One-hour fire wall deletion \$57,000



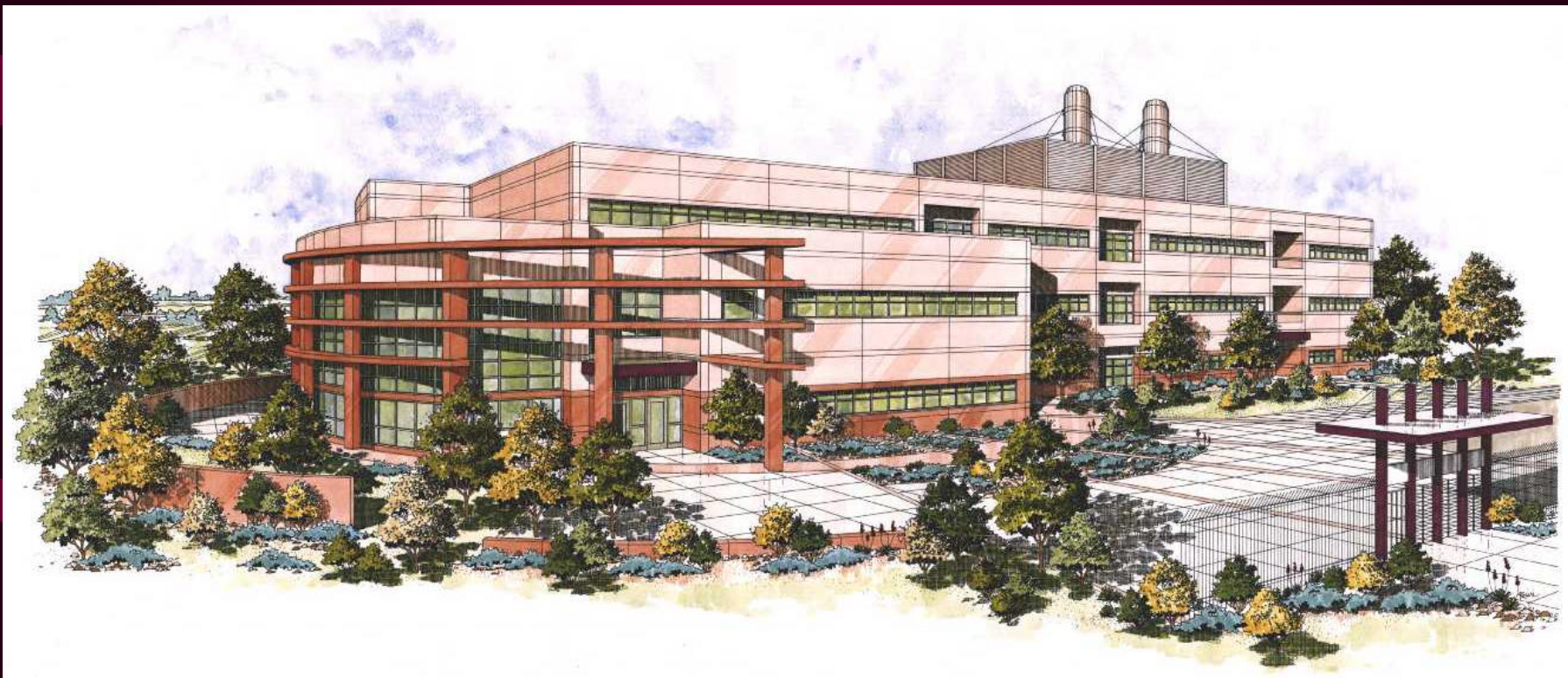
- Diffuser change from slot type \$63,000
  - Delete LN2 sub coolers \$29,000
  - Delete some bus ducting \$135,000
- 
- Total Savings for commissioning was a little over \$1,250,000
  - Additional energy savings over the life of the building are calculated to be \$300,000 per year
  - Avoided damages, future maintenance efficiencies, and contractor callbacks will not be taken credit for

# Commissioning vs. Sandia's Normal Approach

- All of the clearly evident savings fall in the “Commissioning Value vs. No Commissioning” category
- Difficult to assign dollar savings to avoided damages or more efficient documentation and training

# Future Commissioning at Sandia

“It Just Makes Sense”



PETL





